Appendix L

Reach 7 Effects

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This analysis discusses the potential effects in Reach 7. These effects include the international border below the Northerly International Boundary (NIB) because the east side of the river is the U.S. and the west side is Mexico. Effects on resources could occur from potential changes in floodflow releases reaching Morelos Diversion Dam as a result of extending the Interim Surplus Guidelines through 2051. Water flowing into Reach 7 is controlled by Mexican operation of Morelos Diversion Dam at the upper end of the reach. Morelos Diversion Dam is the primary diversion point of Colorado River water delivered to Mexico under the *Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande—Treaty between the United States of America and Mexico*, dated February 3, 1944 (1944 Water Treaty).

L.1 Methodology

The analytical approach used to evaluate potential impacts in this reach is the same as that used for the Interim Surplus Guidelines (ISG). The incremental hydrological change between the baseline conditions and the analyzed alternative was determined by modeling the Colorado River system. Environmental baseline conditions are those expected to result from the full development of the river waters. This includes the full development of the water allocated to the lower Colorado River (LCR) Basin and up to 5.9 million acre-feet per year (mafy) of development of the upper Colorado River Basin allocation as recognized by the Colorado River Compact. The same modeling assumptions used for the analysis of impacts on Lake Mead elevations were used for this analysis. A complete discussion of the model and assumptions is found in Appendix J.

The potential effects on the resources in this reach cannot be specifically determined because of the uncertainty of water use once it flows across the NIB and becomes available to Mexico. The waters of the Colorado River, once delivered to Mexico, as agreed upon in the 1944 Water Treaty, are under the jurisdiction of Mexico. The 1944 Water Treaty contains no provisions requiring Mexico to provide water for environmental protection, nor any requirements relating to Mexico's use of that water. It is reasonably foreseeable that Mexico will continue to maximize consumptive use of its Colorado River water apportionment for agricultural, municipal, and industrial purposes.

For clarification it is necessary to distinguish Mexico's receipt of up to 200,000 acre-feet (af) of scheduled surplus water from that of additional water, which this analysis refers to as "excess flows." The 200,000 af of flood control surplus to Mexico is in addition to the amount necessary to supply uses in the United States and the more assured quantity of

1.5 mafy to Mexico. This 200,000 af is scheduled by Mexico and is spread over the entire year as outlined in Article 15 of the 1944 Water Treaty, and is different from the surplus water that will be generated from the surplus guidelines. Excess flows result from flood control operations, unanticipated contributions from events such as flooding along the Gila River, and/or other factors resulting in canceled water orders by water users below Parker Dam. The change in probability of these excess flows is the subject of this analysis. Mexico has complete autonomy as to how they manage apportioned (scheduled surplus water) and excess Colorado River flows.

L.2 Flows Past Morelos Diversion Dam

Currently, water can flow past Morelos Diversion Dam under three circumstances; (1) as a result of canceled water orders that Mexico is unable to divert at Morelos Diversion Dam; (2) during a Gila River flood event; and (3) during flood control releases along the mainstem Colorado River.

Water released from Parker Dam to meet U.S. orders from irrigation districts in Imperial Valley, Coachella Valley, and the LCR Valley, normally takes up to 3 days to reach its point of diversion. Occasionally, unforeseen events, such as localized precipitation, result in irrigation districts canceling these water delivery orders after the water has been released at Parker Dam. Usually, the water is diverted at Morelos Diversion Dam for use in Mexico; however, some of this water may flow past Morelos Diversion Dam. The volume of water passing by Morelos Diversion Dam as a result of cancelled water orders by contract users is rare enough not to have much effect on species and habitat in Reach 7 below the NIB. Mexico has the capability to divert more than its normal water order of 900–5,500 cfs. During those times that Mexico's water order is below 5,500 cfs, they can divert water arriving at Morelos Diversion Dam above their water order. Extension of the surplus criteria will not affect water that flows past the NIB as a result of canceled water orders.

Gila River flows are unaffected by the proposed action and are constant between the baseline and the analyzed alternative. Therefore, those flows are not modeled. It should be noted that the last two events (1993 and 1997) that resulted in significant amounts of water downstream of Morelos Diversion Dam were caused by Gila River floodflows entering the Colorado River upstream, not floodflow releases in the Colorado River mainstem.

L.3 Baseline Condition

Excess flows below Morelos Diversion Dam are almost entirely attributable to flood control releases originating at Hoover Dam. These flood control releases are dictated by the flood control criteria established for Lake Mead and Hoover Dam and are dependent on hydrologic conditions. Mexico can schedule up to 200,000 af annually during years when flood control releases occur; however, it is important to remember that the water that flows beyond the NIB is managed by Mexico and may be used for their beneficial human uses and, therefore, may not flow down Reach 7. As floodflows arrive at Morelos

Diversion Dam, Mexico has the discretion to divert more water than their water order or allow all the additional flows to move downstream of Morelos Diversion Dam. In the past, Mexico has generally chosen to increase its diversion for use in agriculture for increased crop production and soil salinity improvement, or for diluting flows delivered at the Southerly International Boundary, municipal and industrial uses, or to recharge groundwater aquifers in the Mexicali Valley.

Both the frequency and magnitude of excess flows are important factors in restoring and maintaining riparian habitat below Morelos Diversion Dam. Those flows are analyzed in more detail in this section. It should be emphasized that Mexico's management decisions at and below Morelos Diversion Dam are not modeled because of the uncertainty of what Mexico chooses to do with excess water. Therefore, the hydrologic analyses assume that any water in excess of Mexico's scheduled normal or surplus deliveries are flows that would not be diverted by Mexico and would continue down the LCR channel below Morelos Diversion Dam through Reach 7.

The potential for future excess flows of any magnitude to Reach 7 is shown in Figure L-1 and Table L-1. The frequency of occurrence is computed by counting the number of modeled traces for each year that has excess annual flows and dividing by the total number of traces (85). As shown in Figure L-1, under baseline conditions, the probability is a maximum of 21 percent in 2018 and then follows a gradually declining trend. The gradual decline in the trend can be attributed to increasing Upper Basin depletions. Under baseline conditions, the frequency of occurrence of flows past Morelos Diversion Dam of any magnitude declines to about 15 percent in 2051.

Predicting magnitudes of flows that could be expected from 2002 until 2051 is difficult. One way is to examine the probability of occurrence of flows greater than specified volumes based on historical data. A volume of 250,000 af was selected for this analysis. This volume of flows may be expected to be generally beneficial for natural resources in Reach 7 (Luecke et al. 1999). Figure L-2 and Table L-2 shows the potential for excess flows of 250,000 af or greater to Mexico under baseline conditions. As illustrated, the probability of excess flows under baseline conditions exceeding 250,000 af is a maximum of 20 percent in 2026 and gradually declines to about 14 percent in 2051. Similarly, Figure L-3 and Table L-3 show the probability of excess flows of 1 maf or greater to be 13 percent in 2021.

L.4 Comparison of the Analyzed Alternative to the Baseline Condition

Figure L-1 presents a graphic comparison of future frequency of excess flows of any magnitude to Mexico under the analyzed alternative to those under the baseline conditions. The probability of excess flows of any magnitude to Mexico for the analyzed alternative is compared to baseline conditions for selected years in Table L-1. The analyzed alternative shows slightly higher probability of occurrence compared to the baseline through 2019. This higher probability is attributable to the implementation of water transfers on the LCR that reduce the call for surplus from Lake Mead, resulting in

higher Lake Mead levels. After 2019, the probability of occurrence of excess flows of any magnitude is equal to or slightly less for the baseline and analyzed alternative.

Figure L-2 and Table L-2 show the probability of excess flows to Reach 7 that would exceed 250,000 af in one year. As stated before, this volume was selected for analysis because it may be expected to be generally beneficial for natural resources in Reach 7. This analysis assumes the flows of 250,000 af or greater would arrive at Morelos Diversion Dam at a flow rate that could not be entirely diverted. As stated before, Mexico has complete discretion over use of the water within its diversion capacity once it reaches Morelos Diversion Dam. Mexico has the capacity to divert more than its normal water order; and, therefore, flows within its diversion capacity are expected to be diverted in its entirety. However, examination of International Boundary and Water Commission (IBWC)–reported flows at the Southerly International Boundary (SIB) shows flows accruing throughout the reach ranging from 234,868 af in 2000; 98,947 af in 2001; and 48,771 af in 2002. This indicates water accrues through the reach from smaller amounts bypassed at Morelos Diversion Dam, seepage through the dam, and groundwater accumulation through the reach.

The data displayed in Figure L-2 and Table L-2 for excess flows exceeding 250,000 af in one year show the same trends as the probability of excess flow of any magnitude. That is, there would be a slightly higher probability of occurrence until 2018. After that date, the probabilities are equal or slightly lower between the analyzed alternative and the baseline conditions. These probabilities indicate periodic flows of 250,000 af will continue in any year under the analyzed alternative at about the same expected recurrence level as currently experienced.

The above probabilities indicate conditions below Morelos Diversion Dam would be slightly less than those presumed to be beneficial. Luecke et al. (1999) states it is not yet possible to quantify with certainty the required volume and frequency of these high flows.

Mexico has complete discretion over the use of water entering that country. As stated before, excess flows are generally diverted when possible for uses other than species and habitat. It is only when the amount of water arriving at Mexico is in excess of what can be diverted that benefits to species and habitat can be realized.

Table L-1. Probability of Flows Past Morelos Diversion Dam

Year	Baseline	Proposed Action	Year	Baseline	Proposed Action
Dec-03	0.0%	0.0%	Dec-28	20.0%	20.0%
Dec-04	0.0%	0.0%	Dec-29	18.8%	18.8%
Dec-05	4.7%	4.7%	Dec-30	17.6%	17.6%
Dec-06	5.9%	7.1%	Dec-31	18.8%	18.8%
Dec-07	9.4%	12.9%	Dec-32	18.8%	18.8%
Dec-08	11.8%	16.5%	Dec-33	18.8%	17.6%
Dec-09	14.1%	17.6%	Dec-34	17.6%	17.6%
Dec-10	17.6%	20.0%	Dec-35	20.0%	17.6%
Dec-11	15.3%	18.8%	Dec-36	18.8%	18.8%
Dec-12	17.6%	18.8%	Dec-37	17.6%	17.6%
Dec-13	17.6%	18.8%	Dec-38	15.3%	14.1%
Dec-14	15.3%	18.8%	Dec-39	17.6%	17.6%
Dec-15	11.8%	14.1%	Dec-40	14.1%	14.1%
Dec-16	15.3%	16.5%	Dec-41	16.5%	15.3%
Dec-17	17.6%	20.0%	Dec-42	16.5%	16.5%
Dec-18	18.8%	21.2%	Dec-43	12.9%	11.8%
Dec-19	21.2%	21.2%	Dec-44	14.1%	14.1%
Dec-20	18.8%	17.6%	Dec-45	16.5%	16.5%
Dec-21	21.2%	21.2%	Dec-46	12.9%	12.9%
Dec-22	18.8%	18.8%	Dec-47	15.3%	14.1%
Dec-23	18.8%	17.6%	Dec-48	15.3%	14.1%
Dec-24	18.8%	17.6%	Dec-49	14.1%	14.1%
Dec-25	18.8%	18.8%	Dec-50	15.3%	14.1%
Dec-26	20.0%	20.0%	Dec-51	15.3%	15.3%
Dec-27	21.2%	20.0%			

Table L-2. Probability of Flows Past Morelos Diversion Dam Exceeding 250,000 Acre-Feet

Year	Baseline	Proposed Action	Year	Baseline	Proposed Action
Dec-03	0.0%	0.0%	Dec-28	18.8%	18.8%
Dec-04	0.0%	0.0%	Dec-29	18.8%	18.8%
Dec-05	4.7%	4.7%	Dec-30	16.5%	15.3%
Dec-06	5.9%	5.9%	Dec-31	16.5%	14.1%
Dec-07	8.2%	11.8%	Dec-32	17.6%	18.8%
Dec-08	11.8%	15.3%	Dec-33	16.5%	16.5%
Dec-09	12.9%	16.5%	Dec-34	14.1%	12.9%
Dec-10	15.3%	17.6%	Dec-35	17.6%	15.3%
Dec-11	15.3%	16.5%	Dec-36	17.6%	17.6%
Dec-12	16.5%	18.8%	Dec-37	14.1%	12.9%
Dec-13	17.6%	18.8%	Dec-38	15.3%	14.1%
Dec-14	14.1%	18.8%	Dec-39	16.5%	15.3%
Dec-15	11.8%	14.1%	Dec-40	12.9%	12.9%
Dec-16	12.9%	16.5%	Dec-41	14.1%	14.1%
Dec-17	17.6%	18.8%	Dec-42	16.5%	14.1%
Dec-18	17.6%	21.2%	Dec-43	10.6%	11.8%
Dec-19	18.8%	17.6%	Dec-44	12.9%	12.9%
Dec-20	16.5%	16.5%	Dec-45	16.5%	16.5%
Dec-21	17.6%	15.3%	Dec-46	11.8%	11.8%
Dec-22	16.5%	17.6%	Dec-47	14.1%	14.1%
Dec-23	18.8%	17.6%	Dec-48	11.8%	11.8%
Dec-24	16.5%	17.6%	Dec-49	11.8%	11.8%
Dec-25	17.6%	17.6%	Dec-50	12.9%	11.8%
Dec-26	20.0%	16.5%	Dec-51	14.1%	14.1%
Dec-27	20.0%	18.8%			

Table L-3. Probability of Flows Past Morelos Diversion Dam Exceeding 1 Million Acre-Feet

Year	Baseline	Proposed Action	Year	Baseline	Proposed Action
Dec-03	0.0%	0.0%	Dec-28	9.4%	10.6%
Dec-04	0.0%	0.0%	Dec-29	9.4%	9.4%
Dec-05	1.2%	3.5%	Dec-30	9.4%	9.4%
Dec-06	3.5%	3.5%	Dec-31	9.4%	9.4%
Dec-07	3.5%	3.5%	Dec-32	8.2%	9.4%
Dec-08	9.4%	9.4%	Dec-33	10.6%	9.4%
Dec-09	8.2%	9.4%	Dec-34	8.2%	9.4%
Dec-10	9.4%	12.9%	Dec-35	9.4%	9.4%
Dec-11	9.4%	9.4%	Dec-36	9.4%	9.4%
Dec-12	10.6%	11.8%	Dec-37	8.2%	8.2%
Dec-13	9.4%	10.6%	Dec-38	8.2%	7.1%
Dec-14	9.4%	10.6%	Dec-39	8.2%	7.1%
Dec-15	8.2%	7.1%	Dec-40	10.6%	10.6%
Dec-16	8.2%	9.4%	Dec-41	8.2%	7.1%
Dec-17	10.6%	11.8%	Dec-42	8.2%	7.1%
Dec-18	9.4%	11.8%	Dec-43	8.2%	9.4%
Dec-19	10.6%	10.6%	Dec-44	9.4%	11.8%
Dec-20	10.6%	10.6%	Dec-45	8.2%	8.2%
Dec-21	12.9%	12.9%	Dec-46	7.1%	7.1%
Dec-22	10.6%	10.6%	Dec-47	7.1%	8.2%
Dec-23	9.4%	8.2%	Dec-48	8.2%	7.1%
Dec-24	9.4%	10.6%	Dec-49	7.1%	7.1%
Dec-25	9.4%	9.4%	Dec-50	8.2%	7.1%
Dec-26	10.6%	10.6%	Dec-51	7.1%	5.9%
Dec-27	12.9%	11.8%			

L.5 Summary

In summary, there are only minor differences in the potential magnitudes and potential frequencies of excess flows between baseline conditions and the analyzed alternative. These differences are not expected to be significant.

L.6 Reference Cited

Luecke, D. F., J. Pitt, C. Congdon, E. Glenn, C. Valdes-Casillas, and M. Briggs. 1999. *A Delta once more: restoring riparian and wetland habitat in the Colorado River Delta*. Washington, DC: EDF Publications.

Figure L-1
Probability of Flows Past Morelos Diversion Dam

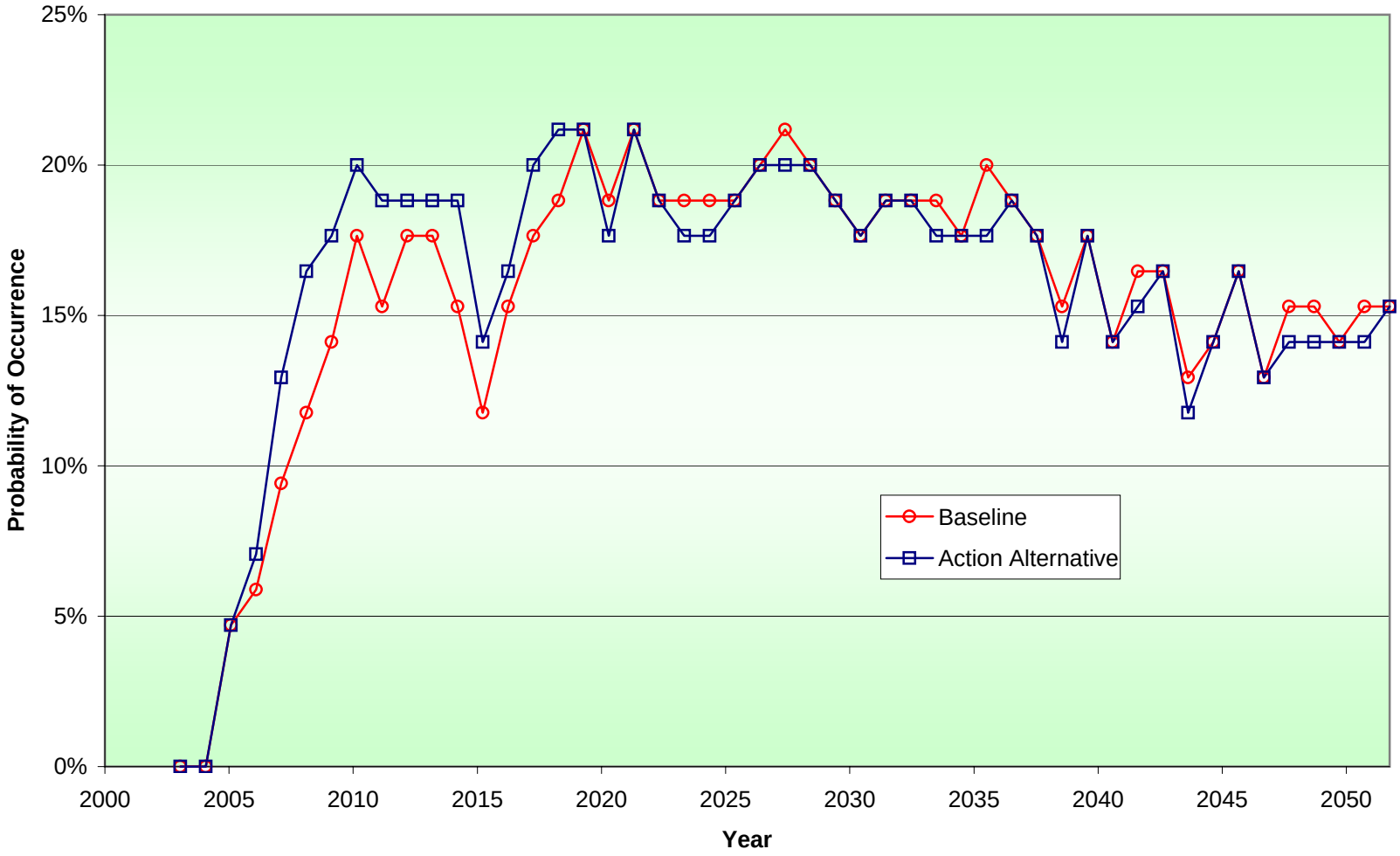

Figure L-2
Probability of Flows Past Morelos Diversion Dam
Exceeding 250,000 Acre-Feet

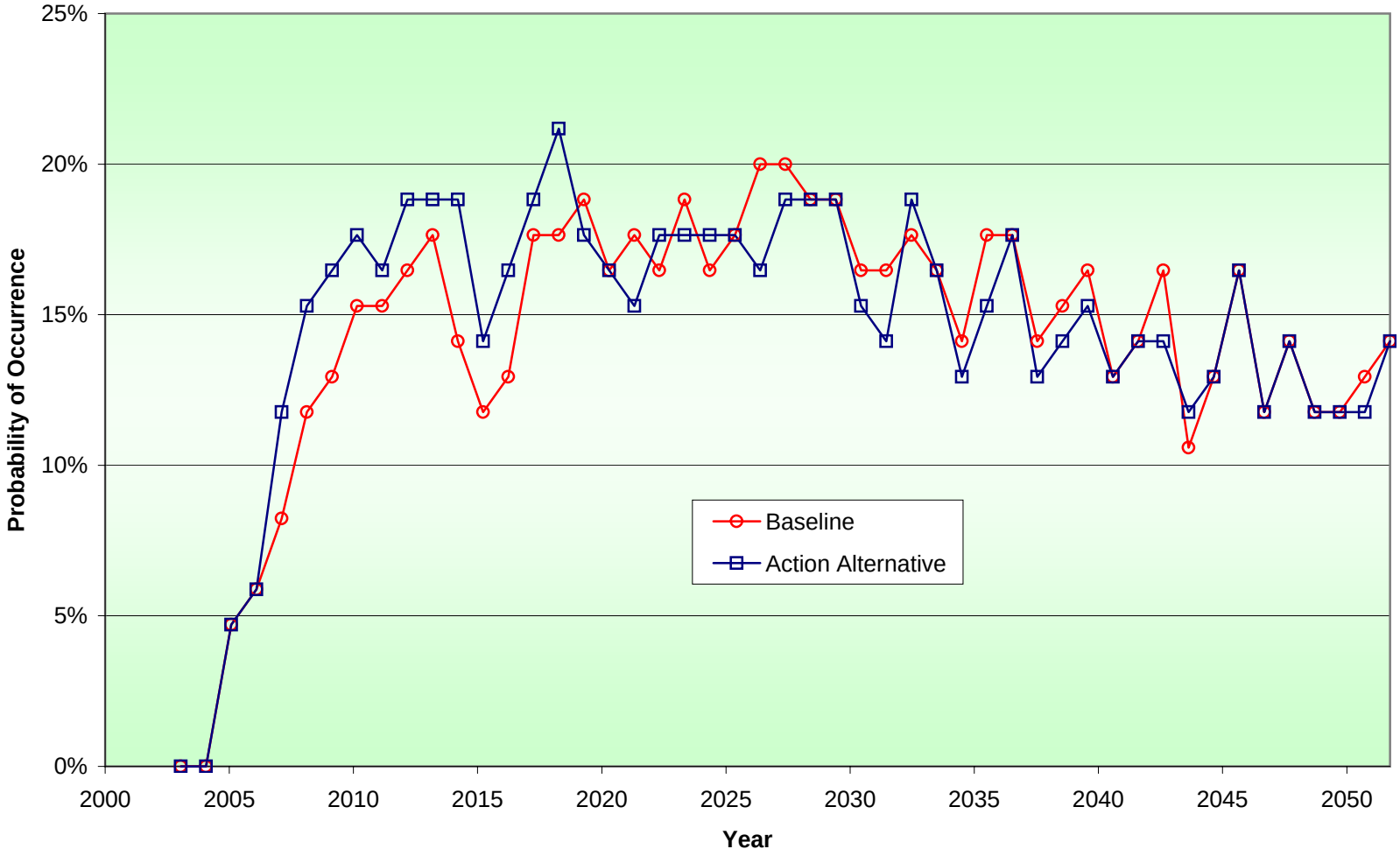

Figure L-3
Probability of Flows Past Morelos Diversion Dam
Exceeding 1,000,000 Acre-Feet